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## PATENT ABSTRACTS OF JAPAN

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(21)Application number : 2000-373505 (71)Applicant : KUMAGAI GUMI CO LTD  
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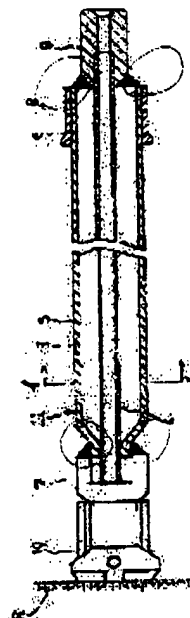
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TSUKADA MASAHIRO

## (54) EXPANSION-TYPE STEEL PIPE SELF-DRILLING ROCK BOLT

## (57)Abstract:

PROBLEM TO BE SOLVED: To facilitate tunnel construction in the ground in which the inside of a drilled hole easily collapses.

SOLUTION: A bit 10 for drilling a rock mass R, etc., as ejecting drilling water is arranged at a tip part. An inner pipe 4 for supplying the drilling water is connected to the rear of the center part of the bit 10. An outer pipe 3 which is smaller than the outer diameter of the bit 10, of which both end parts are closed, and which comprises both a fluid injection opening 8 at one end part and a tubular shape capable of expanding by pressurization from the fluid injection opening 8 is arranged outside the inner pipe 4.



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model  
→ problem  
is shown  
can be solved  
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CLAIMS

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[Claim(s)]

[Claim 1] The expanded type steel pipe self-punching rock bolt characterized by to arrange the outer tube which arranges in a point the bit which punches a base rock etc., injecting punching water, is smaller than the outer diameter of this bit on the outside of this inner tube, and closes both ends while forming successively the inner tubes which supply this punching water behind [ core ] this bit, has a fluid inlet in the end section, is further pressurized from this fluid inlet, and has the pipe configuration where it can expand.

[Claim 2] The expanded type steel pipe self-punching rock bolt according to claim 1 characterized by taking at a time 45 degrees of positions which the cross-section configuration of the aforementioned outer tube has the hollow of eight directions, and face the center of the aforementioned inner tube of this hollow, and forming regular intervals to a bolt medial axis.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] the hole which punched this invention especially about the expanded type steel pipe self-punching rock bolt -- it is related with the expanded type steel pipe self-punching rock bolt which can perform easily construction in the natural ground where the interior tends to collapse

[0002]

[Description of the Prior Art] Conventionally, the rock bolt made from a steel pipe indicated by JP,2-520,B and JP,2-5238,B as an object for the base rock reinforcement at the time of construction of a tunnel etc. is used.

[0003] According to drawing 5 (a) and (b), the operation of this rock bolt 1 made from a steel pipe is explained. The both ends of this rock bolt 1 made from a steel pipe are closed, and prepare a fluid inlet in the end section, enclose high-pressure water etc. from this fluid inlet, expand a pipe and fix it to the base rock R which is a natural ground. here, it is shown in this base rock R at drawing 5 (a) -- as -- the cross section of a circumference smaller than the circumference of the cross section of this rock bolt 1 made from a steel pipe -- the circular hole 2 -- punching -- this -- this rock bolt 1 made from a steel pipe closed at both ends is inserted in a hole 2

[0004] The cross-section configuration of this rock bolt 1 made from a steel pipe at the angle at which a periphery exceeds 180 degrees at a \*\*\*\* real target Therefore, a partial periphery zone, the cross-section configuration which spreads across the center of a circle that have one hollow which opposes the zone of this partial periphery, and this hollow makes this partial periphery a part [ a periphery ] -- carrying out -- a circumference still longer than the circumference of the hole 2 of the aforementioned base rock R -- having -- this -- before insertion of a hole 2, it is shown in drawing 5 (a) -- as -- this -- it is made smaller than the diameter of a hole 2

[0005] this rock bolt 1 made from a steel pipe -- this -- after inserting in a hole 2, when pressurization expansion is carried out with a pressurizer, as shown in drawing 5 (b), the cross-section configuration of this rock bolt 1 made from a steel pipe will be expanded, and it can fix to this base rock R however, this rock bolt made from a steel pipe -- a natural ground -- the hole which the character was applied in many cases in the unstable tunnel, and punched such a natural ground -- since the interior tends to collapse, insertion of this rock bolt made from a steel pipe becomes difficult

[0006] then, the hole punched by punching a natural ground by the rock bolt itself -- the technical technical problem which should be solved in order to obtain the expanded type steel pipe self-punching rock bolt which can perform easily construction in the natural ground where the interior tends to collapse arises, and this invention aims at solving this technical problem

[0007]

[Means for Solving the Problem] While forming successively the inner tubes which arrange in a point the bit which punches a base rock etc., and supply this punching water behind [ core ] this bit, injecting [ this invention is proposed in order to attain the above-mentioned purpose, and ] punching water It is smaller than the outer diameter of this bit on the outside of this inner tube, and close both ends, and it has a fluid inlet in the end section. Furthermore, the expanded type steel pipe self-punching rock bolt which arranges the outer tube which is pressurized from this

fluid inlet and has the pipe configuration where it can expand, And the expanded type steel pipe self-punching rock bolt which takes at a time 45 degrees of positions which the cross-section configuration of the aforementioned outer tube has the hollow of eight directions, and face the center of the aforementioned inner tube of this hollow, and forms regular intervals to a bolt medial axis is offered.

[0008]

[Embodiments of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained in full detail according to drawing 1 or drawing 4. Drawing 1 shows the vertical section side elevation of the expanded type steel pipe self-punching rock bolt (henceforth a self-punching rock bolt) 11, and forms the bit 10 which punches the base rock R which is a natural ground in a point (left-hand side of drawing). It is referred to as 45mm and the outer diameter of this bit 10 forms the sleeve 7 connected to the periphery of the outer tube 3 mentioned later by welding in the back. Moreover, behind [ core ] this bit 10, it lets this sleeve 7 pass, and the inner tubes 4 with an outer diameter of 10.5mm which supplies the punching water for punching a base rock R at a point are formed successively.

[0009] Furthermore, it is smaller than the outer diameter of this bit 10 on the outside of this inner tube 4, for example, the outer tube 3 with an outer diameter of 37mm is formed in it. The point of this outer tube 3 is closed by the sleeve 6 with which it is closed by the aforementioned sleeve 7 and the peripheral face of this inner tube 4, and the back end section is also \*\*\*\*(ed) by the periphery of this outer tube 3, the rod 9 welded to the end face of this outer tube 3, and the peripheral face of this inner tube 4. Moreover, the fluid inlet 8 is trepanned in the end section of the periphery of this sleeve 6, high-pressure water etc. is enclosed from the aperture prepared in the homotopic of this outer tube 3 in the space section 5 between the bore of this outer tube 3, and the outer diameter of the aforementioned inner tube 4, a pipe is expanded and the aforementioned self-punching rock bolt 11 is fixed to the base rock R which is a natural ground.

[0010] Next, the pipe configuration of this outer tube 3 is explained according to drawing 2 (a). This outer tube 3 manufactures the self-punching rock bolt 11 with an outer-diameter size of 37mm by the cold drawing method from a round pipe (not shown) with an outer-diameter size of 60.5mm. The space section 5 which lets the aforementioned inner tube 4 arranged in the core of this outer tube 3 pass is formed with a plug (not shown), for example, forms a hole with a diameter of 13mm. Moreover, the cross-section configuration of this outer tube 3 has the hollow 12 of eight directions, and 12 -- at equal intervals on the outside which is confronted with this plug and prepared. And these hollows 12 and 12 -- Maximum pars-basilaris-ossis-occipitalis 12a and 12a-- faces to the center of the aforementioned round pipe. It forms identically to the cross section which forms between the dices (not shown) of this hollow 12 and 12 -- which have parallel or the narrowed configuration by cold drawing from this round pipe as the interval of the sides 13 and 13 goes to the bolt medial axis L outside opening.

[0011] Furthermore, it takes and forms at a time 45 degrees of positions of this hollow 12 and 12 - which face the center of this round pipe for regular intervals to this bolt medial axis L. Moreover, the outer diameter of this outer tube 3 is touched, and this hollow 12 and the radius size of the circular height 14 which projects among 12 are set to 4.8mm. Thus, since the rectilinear-propagation nature at the time of manufacture of a pipe is maintained and stress is acting on the whole by putting each bases on \*\* at a relative position, generating of deflection is pressed down.

[0012] Next, according to drawing 2 (b), the interlocking state to the base rock R at the time of expansion of this outer tube 3 is explained. Drawing 2 (b) shows the cross section of this outer tube 3 at the time of expansion, presses fit the pouring material C mentioned later, and is made to fix it to a base rock R by stiffening the pouring material C which this outer tube 3 was expanded and poured it in within this outer tube 3. In that case, the circular height 14 of this outer tube 3 shown in drawing 2 (a) is bent until it contacts punching 2, and the sides 13 and 13 and maximum bottom 12a are extruded outside the aforementioned hollow 12 to the method portion of outside.

[0013] In addition, since the periphery length of this outer tube 3 of an expansion front and after expansion is the same, it has the effect of reducing the risk of the crack of this pipe. Moreover,

this hollow 12 and 12 -- have a configuration to which it spreads in a longitudinal direction like illustration at the time of expansion, or the inner sides 13a and 13a become parallel.

[0014] Next, drawing 3 (a) shows the operation state of the pressure to this hollow 12 at the time of expansion, and an internal pressure acts this hollow 12 the inner sides 13a and 13a in the compression direction, and holds the width-of-face size W of opening of this hollow 12. Then, as shown in drawing 3 (b), when this internal pressure is removed, the force works [ these inner sides 13a and 13a ] in the direction of the other side to the method of outside (upper part of drawing). Therefore, the force of the direction which the width-of-face size W of the aforementioned opening of this hollow 12 expands by alpha size will act. This force will increase the friction maintenance between the aforementioned punching 2 and the aforementioned self-punching rock bolts 11 which are shown in drawing 2 (b), and becomes what has certain fixation to the aforementioned base rock R. In addition, since the hollow 12 shown in drawing 2 and eight 12 -- are prepared, interlocking to this base rock R becomes still more certain.

[0015] Moreover, since this self-punching rock bolt 11 has eight hollows 12 and 12 -- at equal intervals outside, a pressure can be uniformly given to a circumferencial direction by expansion of the steel pipe mentioned later. Therefore, when a natural ground carries out the shape of strange and axial tension arises in this self-punching rock bolt 11, the uniform drawing force will occur, and the reliability of drawing proof stress improves. Moreover, the shear proof stress stabilized without being influenced in the shearing-force direction since the pipe cross-section configuration was symmetrical on four directions when a natural ground carried out the shape of strange and shearing force joined this self-punching rock bolt 11 can be demonstrated.

[0016] Next, according to drawing 4 (a) and (b), the operation of this self-punching rock bolt 11 is explained. this self-punching rock bolt 11 -- a natural ground -- the hole which a character is an unstable tunnel and punched especially -- it is used for construction in the natural ground where the interior tends to collapse First, as shown in drawing 4 (a), the aforementioned bit 10 punches a base rock R itself, and the self-punching rock bolt 11 of predetermined length is held in this base rock R. therefore, the punched hole -- even if the interior collapses, this self-punching rock bolt 11 can be easily held in this base rock R Moreover, the outer tube 3 which has the pipe configuration where it can expand, behind this bit 10 is also held in this punching 2.

[0017] Then, it lets a pressurizer 16 and a hose 15 pass from the aforementioned fluid inlet 8 prepared in the aforementioned sleeve 6, as shown in drawing 4 (b), the pouring material C, such as synthetic resin of mortar, cement milk, or hardenability, is pressed fit in the aforementioned outer tube 3, and this outer tube 3 is expanded, and it is made to fix to this base rock R by stiffening this pouring material C within this outer tube 3 in the state. In addition, the antisuckback function is prepared in this fluid inlet 8.

[0018] Moreover, although illustration is omitted, the thin-walled part thinner than other thickness is beforehand prepared in a part of point by the side of the aforementioned bit 10 of this outer tube 3, and this thin-walled part is destroyed by the pressure which expansion of this outer tube 3 completes. Therefore, when this outer tube 3 breaks, it will fill up with the aforementioned pouring material C between the external surface of the aforementioned self-punching rock bolt 11, and the aforementioned punching 2, and by hardening of this pouring material C, the adhesion force increases and the drawing frictional force between this self-punching rock bolt 11 and a natural ground increases.

[0019] Moreover, this [ self-punching rock-bolt 11 / itself ] is protected from air, water, etc. by this pouring material C, and long-term endurance improves. Furthermore, the thing for which this pouring material C is stiffened within this outer tube 3 Not only the shear proof stress of a steel pipe but the shearing force of this pouring material C is added to the shearing force produced according to the shape of strange. a natural ground -- Since this pouring material C is restrained by this outer tube 3 while the shear proof stress of the self-punching rock-bolt 11 aforementioned whole improves, bigger shear proof stress than the proof stress which added the shear proof stress of the steel pipe itself and the pouring material itself according to the restricted effect is demonstrated.

[0020] In addition, this invention can succeed in various alterations, unless it deviates from the

soul of this invention, and it is natural. [ of attaining to that by which this invention was this changed ]

[0021]

[Effect of the Invention] As explained above, since invention according to claim 1 is arranging the bit which punches a point itself, and the outer tube which has the inner tube which supplies punching water to the back, and the pipe configuration which can be expanded, punching of a base rock and insertion of a rock bolt can perform it by one work, and it can plan working efficiency and cost reduction.

[0022] moreover, the hole punched since it had the self-punching function -- construction in the natural ground where the interior tends to collapse can be performed easily

[0023] while the steel pipe with which a knee does not generate the position where the cross-section configuration of an outer tube has the hollow of eight directions in addition to the effect of the invention of the claim 1 aforementioned publication, and invention according to claim 2 faces the center of the aforementioned inner tube of this hollow at the time of manufacture since it takes 45 degrees of regular intervals at a time to a bolt medial axis and they are formed is obtained, at the time of expansion, the effect that the height which it is between these hollows eats away certainly to a punching side is demonstrated

[0024] Moreover, the shear proof stress stabilized without being influenced in the shearing-force direction since the pipe cross-section configuration was symmetrical on four directions when a natural ground carried out the shape of strange and shearing force joined a steel pipe can be demonstrated.

[0025] Thus, that digging workability, such as a tunnel, improves etc. is invention which just does so a variety of effect it is ineffective work size.

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[Translation done.]

**EXPANSION-TYPE STEEL PIPE SELF-DRILLING ROCK BOLT**

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Veröffentlichungsdatum : 2002-08-21  
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Anmelder : KUMAGAI GUMI CO LTD.; SANWA KOKAN KK; HOKUETSU  
METAL CO LTD  
Originalnummer : ☐ JP2002174100  
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Patentschriften

**Zusammenfassung**

**PROBLEM TO BE SOLVED:** To facilitate tunnel construction in the ground in which the inside of a drilled hole easily collapses.

**SOLUTION:** A bit 10 for drilling a rock mass R, etc., as ejecting drilling water is arranged at a tip part. An inner pipe 4 for supplying the drilling water is connected to the rear of the center part of the bit 10. An outer pipe 3 which is smaller than the outer diameter of the bit 10, of which both end parts are closed, and which comprises both a fluid injection opening 8 at one end part and a tubular shape capable of expanding by pressurization from the fluid injection opening 8 is arranged outside the inner pipe 4.

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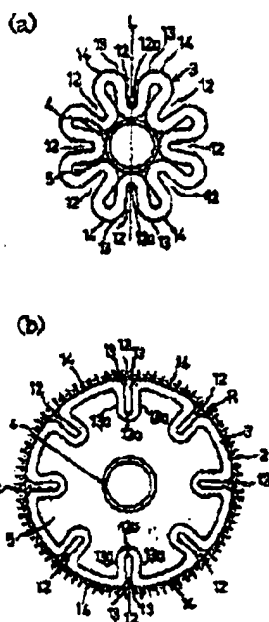
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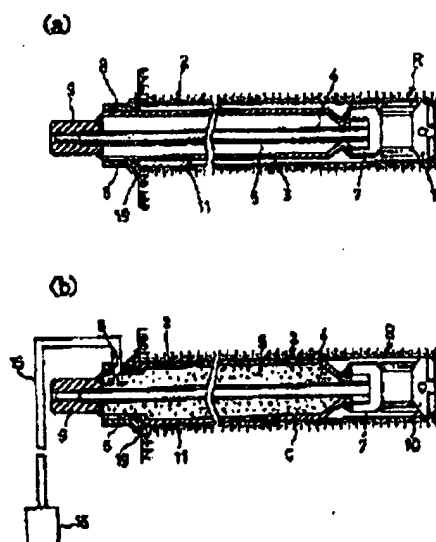
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(5) 002-174100 (P2002-17158)

【図2】



【図4】



フロントページの続き

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NR.202 5.19

(4) 002-174100 (P2002-17) 58

膨張時には液圧面の突起部が穿孔面に対して確実に食い込む効果が期待される。

【0024】又、地山が変状して解きにせん断力が加わった場合に於ても、管部形状が上下左右で対称であるのでせん断力の方向に左右されることなく安定したせん断断力を実現することができる。

【0025】斯くして、トンネル等の掘削施工性が向上する等、正に特許の著大な効果をもたらす発明である。

【図面の簡単な説明】

【図1】本発明の一実施の形態を示し、自膨孔ロックボルトの縦断面図。

【図2】(a) 図1のイーイー断面図。

(b) 外管の穿孔内での膨張状態を示す縦断面図。

【図3】(a) 膨張時の圧力への圧力の作用状態を示す縦断面図。

(b) 内部圧力を除去した状態を示す圧力の縦断面図。

【図4】(a) 岩壁への自膨孔ロックボルトの収容状態

を示す縦断面図。

(b) 自膨孔ロックボルトが穿孔内で膨張した状態を示す縦断面図。

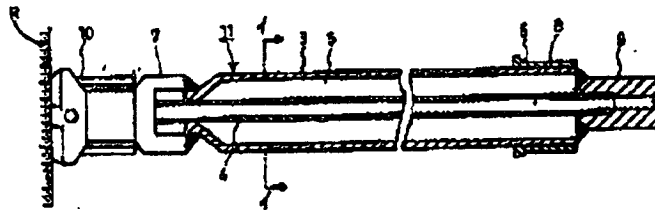
【図5】(a) 従来例の管部ロックボルトの縦断面図。

(b) 従来例の管部ロックボルトの穿孔内での膨張状態を示す縦断面図。

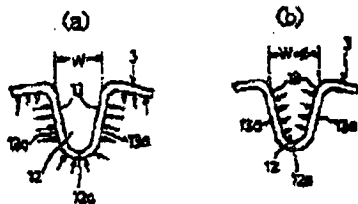
【符号の説明】

- |    |                |
|----|----------------|
| 2  | 穿孔             |
| 3  | 外管             |
| 4  | 内管             |
| 8  | 液体注入口          |
| 10 | ビット            |
| 11 | 膨張用管部自膨孔ロックボルト |
| 12 | 圧力             |
| L  | ボルト中心線         |
| R  | 岩壁             |

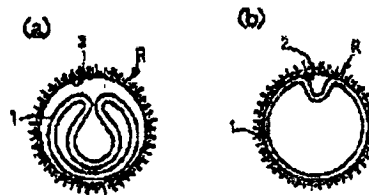
【図1】



【図3】



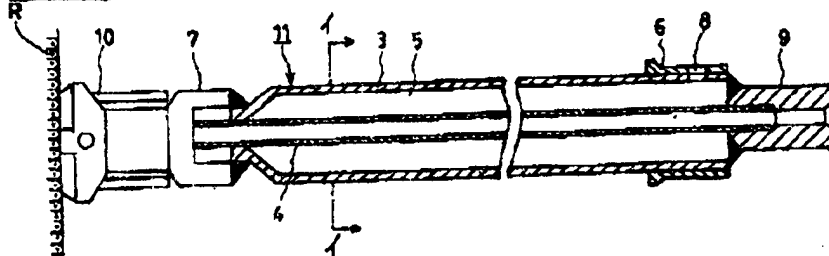
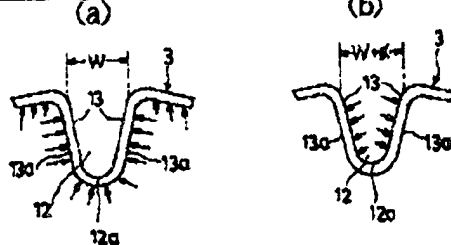
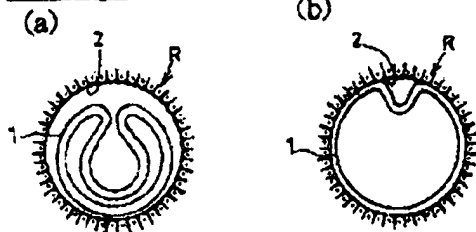
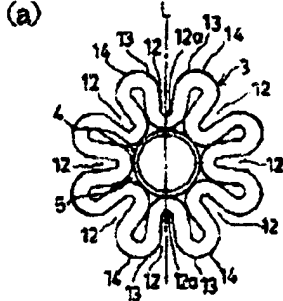
【図5】

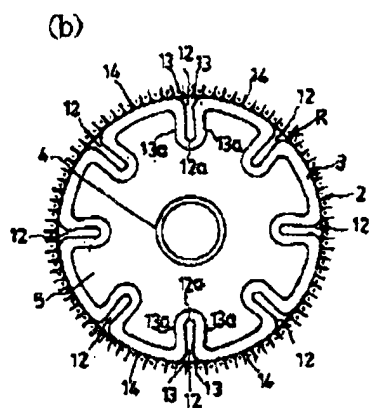


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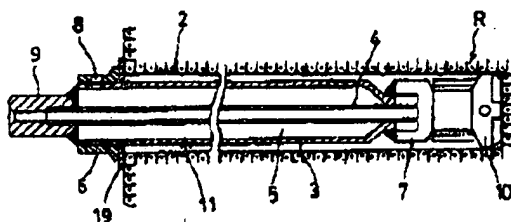
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DRAWINGS[Drawing 1][Drawing 3][Drawing 5][Drawing 2]

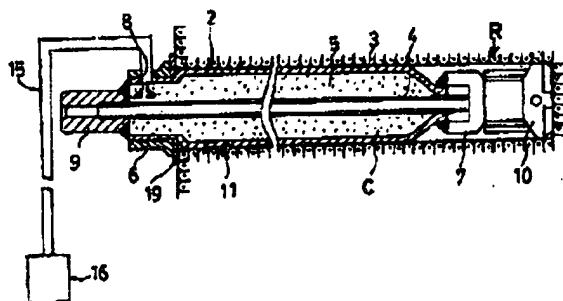


[Drawing 4]

(a)



(b)



[Translation done.]

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